

CLAIMS

1. A pulse wave measuring apparatus comprising:

a substrate (1) having pressure-sensing means (3) on a main surface; and

5 a protection member (12) having an accommodation space accommodating said substrate (1), the pulse wave measuring apparatus serving to measure a pulse wave by pressing said substrate (1) against a living body; wherein

10 a wall surface (20a) of said protection member (12) forming said accommodation space is arranged such that an air chamber (20) is interposed between said wall surface and an end surface of said substrate (1).

2. The pulse wave measuring apparatus according to claim 1, wherein

said air chamber (20) is provided around an entire perimeter of said substrate (1).

15 3. The pulse wave measuring apparatus according to claim 1, wherein  
said air chamber (20) is open to atmosphere.

20 4. The pulse wave measuring apparatus according to claim 1, further comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein  
said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12), a connection portion (18b) connected to said substrate (1), and a loosened portion (18c) located between said fixed portion (18a) and said connection portion (18b).

25

5. The pulse wave measuring apparatus according to claim 4, wherein  
said loosened portion (18c) is located inside said air chamber (20).

6. The pulse wave measuring apparatus according to claim 1, further comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein  
5           said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12) and a connection portion (18b) connected to said substrate (1), and  
              a portion (18d) having rigidity different from that of another portion of said flexible line (18) is located between said fixed portion (18a) and said connection portion (18c) of said flexible line (18).

10           7. The pulse wave measuring apparatus according to claim 1, further comprising  
              a protection film (16) covering said main surface of said substrate (1) and said air chamber (20), and  
              attachment means (42) for fastening a peripheral portion of said protection film  
15           (16) to an outer circumferential wall of said protection member (12) for attachment.

20           8. The pulse wave measuring apparatus according to claim 7, wherein  
              said protection member (12) has a substantially circular outer shape when viewed from a direction orthogonal to said main surface of said substrate (1), and  
              said attachment means (42) is an O ring.

25           9. The pulse wave measuring apparatus according to claim 8, wherein  
              said outer circumferential wall of said protection member (12) has a concave fitting portion (47) fitting to an inner portion of said O ring (42) on an entire circumference, and  
              an outer portion of said O ring (42) projects from said outer circumferential wall of said protection member (12).

10. The pulse wave measuring apparatus according to claim 7, wherein  
said protection film (16) and said attachment means (42) are integrally formed.
- 5           11. The pulse wave measuring apparatus according to claim 7, wherein  
said protection film (16) has a collar portion (16a) in said peripheral portion.
- 10           12. The pulse wave measuring apparatus according to claim 1, wherein  
said protection member (12) includes an inner frame body (44) containing said  
accommodation space and an outer frame body (46) fitted to said inner frame body (44),  
so as to enclose an outer wall of said inner frame body (44),  
said outer frame body (46) has a protection film portion (46d) covering said  
main surface of said substrate (1) and said air chamber (20), and  
an outer circumferential wall of said outer frame body (46) has a projected  
portion (46c) on its entire circumference.
- 15           13. The pulse wave measuring apparatus according to claim 1, further  
comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a  
signal output from said pressure-sensing means (3) to said circuit board (26), wherein  
said protection member (12) includes an inner frame body (44) containing said  
accommodation space and an outer frame body (46) fitted to said inner frame body (44)  
so as to enclose an outer wall of said inner frame body (44), and  
said flexible line (18) is inserted between said inner frame body (44) and said  
outer frame body (46).
- 25           14. The pulse wave measuring apparatus according to claim 13, wherein  
said outer frame body (46) has an overhanging portion (46a) provided so as to  
project from an inner surface of said outer frame body (46) and facing, with a distance, a  
perimeter of an accommodation space forming surface of said inner frame body (44)

where said accommodation space is formed, and

said flexible line (18) inserted between said inner frame body (44) and said outer frame body (46) is protected by said overhanging portion (46a).

5        15. The pulse wave measuring apparatus according to claim 1, wherein  
          said protection member (12) is formed with a conductive material.

10        16. The pulse wave measuring apparatus according to claim 15, wherein  
          said protection member (12) is electrically connected to a ground potential.

15        17. The pulse wave measuring apparatus according to claim 16, further  
          comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a  
          signal output from said pressure-sensing means (3) to said circuit board (26), wherein  
          said protection member (12) is electrically connected to the ground potential by  
          means of said flexible line (18).

20        18. The pulse wave measuring apparatus according to claim 1, wherein  
          said protection member (12) is formed with a metal material or a ceramic  
          material.

25        19. The pulse wave measuring apparatus according to claim 1, wherein  
          said protection member (12) has a plurality of small irregularities on its surface.

20        20. A pulse wave measuring apparatus for measuring a pulse wave by pressing  
          against a living body a substrate (1) having pressure-sensing means (3) on a main  
          surface; wherein  
          said substrate (1) has a groove (4) around said pressure-sensing means (3).

21. The pulse wave measuring apparatus according to claim 20, further comprising a protection member (12) protecting said substrate (1), a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

5           said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12), a connection portion (18b) connected to said substrate (1), and a loosened portion (18c) located between said fixed portion (18a) and said connection portion (18b).

10          22. The pulse wave measuring apparatus according to claim 20, further comprising a protection member (12) protecting said substrate (1), a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

15           said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12) and a connection portion (18b) connected to said substrate (1), and

              said flexible line (18) includes a portion (18d) having different rigidity between said fixed portion (18a) and said connection portion (18b).

20          23. A pulse wave measuring apparatus comprising:  
              a substrate (1) having pressure-sensing means (3) on a main surface;  
              a circuit board (26) processing a signal; and  
              a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), the pulse wave measuring apparatus serving to measure a pulse wave by pressing said substrate (1) against a living body; wherein

25           said substrate (1) has a connection electrode portion (5a) connected to said flexible line (18), in a position lower than said main surface.

24. The pulse wave measuring apparatus according to claim 23, wherein

5 said substrate (1) has a stepped-down portion (6) on a main surface, and  
said stepped-down portion (6) has said connection electrode portion (5a) formed.

10 25. The pulse wave measuring apparatus according to claim 24, wherein  
an upper surface of said flexible line (18) located on a side opposite to said  
connection electrode portion (5a) on said stepped-down portion (6) and the main  
surface of said substrate (1) are located on an identical plane.

15 26. The pulse wave measuring apparatus according to claim 24, wherein  
a spacer member (22) is arranged on the upper surface of said flexible line (18),  
and

an upper surface of said spacer member (22) located on a side opposite to said  
flexible line (18) and the main surface of said substrate (1) are located on an identical  
plane.

20 15 27. The pulse wave measuring apparatus according to claim 23, wherein  
said connection electrode portion (5a) is formed on a back surface of said  
substrate.

25 20 28. The pulse wave measuring apparatus according to claim 23, further  
comprising a protection member (12) protecting said substrate (1), a circuit board (26)  
processing a signal, and a flexible line (18) transmitting a signal output from said  
pressure-sensing means (3) to said circuit board (26), wherein  
said flexible line (18) includes a fixed portion (18a) fixed to said protection  
member (12), a connection portion (18b) connected to said substrate (1), and a loosened  
portion (18c) located between said fixed portion (18a) and said connection portion  
(18b).

29. The pulse wave measuring apparatus according to claim 23, further comprising a protection member (12) protecting said substrate (1), a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

5           said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12) and a connection portion (18b) connected to said substrate (1), and

              said flexible line (18) includes a portion (18d) having different rigidity between said fixed portion (18a) and said connection portion (18b).